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PHYSICS DEPENDENT DE-FEATURING. IS IT A PREREQUISITE FOR MESH GENERATION?

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The initial stage of a simulation process is the generation of an appropriate mesh that is designed to capture the required physics. When dealing with complex objects that contain multi-scale geometric details, it is often necessary to manually remove small features which, in the expert opinion of the analyst, will not have a measurable effect on the numerical solution.

The major drawback of this de-featuring stage is the requirement for manual interaction with CAD systems. Furthermore, the de-featuring must be repeated for every physical system to be considered in the design, i.e. fluids, solids, electromagnetics, acoustics, heat transfer, etc. In addition, the de-featuring is often dependent on problem parameters such as the Reynolds number in a fluid mechanics problem or the frequency of the waves in electromagnetics or acoustics.

In this talk, a new computational framework is presented [1]. The proposed technique involves a new mesh generation paradigm where the element size is dictated by the required resolution of the physical phenomena, irrespective of the geometric complexity. All geometric details are encapsulated in the mesh without unnecessary mesh refinement, removing the uncertainty induced by a de-featuring process and ensuring both efficiency and robustness. The modifications of an existing finite element solver, required to utilise the meshes generated with the proposed approach [2], will also be presented.

REFERENCES

[1] R. Sevilla, L. Rees and O. Hassan, The generation of triangular meshes for NURBS-Enhanced FEM. International Journal for Numerical Methods in Engineering, Vol. ***108*** *(8), pp. 941-958, 2016.*

[2] R. Sevilla, S. Fernndez-Mndez and A. Huerta, NURBS-Enhanced Finite Element Method (NEFEM): A seamless bridge between CAD and FEM. Archives of Computational Methods in Engineering, Vol. ***18*** *(4), pp. 441–484, 2011.*